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Physical Properties of Rocks

110 Abstracts/Notes, p. 1-16
Editor: C.R. McElroy, Department of Geology, University of Texas at Austin, TX 78712; Associate Editor: G. R. Thompson, Geological Observatory of Columbia University, Palisades, NY 10572; Associate Editors: J. C. H. Lienard and T. L. Geologic Sciences, Columbia University.

Discusses some properties of igneous rocks, such as density, thermal conductivity, electrical resistivity, and magnetic susceptibility. The author also discusses the relationship between density and magnetic susceptibility.

These properties are obtained by recording two fundamental constants. The first is the

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Thus, corrected deformations are at least as plausible as uncorrected deformations, if closure error is the criterion.

Stein contended that Jackson had grossly overestimated the impact of leveling rod error and argued that Strange's refraction correction has yet to be adequately tested. Stein showed that when tilt measured from resurvey was plotted as a function of topographic slope for 1100 km of routes that are too steep for significant refraction, the mean rod-related elevation-dependent error comes to $(0 \pm 5) \times 10^{-5}$ × the topographic height. In other words, the standard error for levels run over 1000-m topography is about 5 cm. The levels spanned the years 1953–1980; during this period the mean error was about constant. The error tends to cancel over several levels of a route or over more than about 80 km along one route. Since the error does not accumulate, it could not cause the 20–30-cm errors that would be required to interpret the uplift as a rod artifact.

Stein showed that when rod-related errors were removed from a sequence of levels across the uplift, 149 ± 17 mm of uplift results at Grapevine, north of the San Andreas fault at Tejon Pass, relative to Saugus, at the base of the San Gabriel Mountains, compared to 165 ± 9 mm, using observed data. Strange applies less than 10 mm of refraction correction on those surveys since the eight lengths were short and nearly the same for all levels, so this measure of uplift is independent of optical effects.

In his comments on Strange's presentation, Stein first pointed out that Strange's 'refraction-corrected' uplift has approximately the same form as that of Casile, with half the observed amplitude; the difference is one of degree only. In fact the refraction correction of Strange usually amounts to less than 5 cm, and about one-half of the Southern California routes do not change more than the random error. Stein showed that there are seven ways to get to Palmdale from Tidal B in San Pedro, and they all give very consistent results: no uplift between 1926 and the late 1950's, 20 cm by the early 60's, and an additional 15 cm by the early 70's. Since the routes traversed different terrain under different temperature and procedural conditions, Stein felt that this could not be coincidental.

Stein argued that the NGS refraction correction takes the assumed ambient temperature as a function of time of year and location to approximate what is presumed to be stable nonlinear vertical temperature gradient. If the gradient is very unstable, or if it is stable but linear with height, no differential refraction would accumulate. A wind velocity gradient of only 3 m/s (its 4 m · 1 m speed) would reduce the temperature gradient by 50% for Southern California conditions. Stein asserted that the behavior of refraction as a function of wind speed and ground thermal properties (e.g., frost, asphalt, railroad gravel) was unknown. Stein proposed that the USGS run a field experiment between Saugus and Palmdale to spring and solicited the help and expertise of the NGS for its operation. He also recommended that Strange test the NGS refraction correction on the 20 leveling circuits of the 1978 NGS Southern California Relevelling Program to see if the correction significantly reduces the misclosures. Stein closed by showing a 50 km long San Gabriel Mountain leveling route that displays 13 cm of uplift during 1979–80. The same standards and procedures were used for both surveys. No more than 2 cm of this can be explained by rod or refraction corrections, which indicates that a mobile crust exists in Southern California and that this mobility is not confined to the 1980's.

During the discussion period which followed the presentation, it became apparent that all three had used much the same data but had come to markedly different conclusions. There was a question about whether movement of station Woody, in the Sierra Nevada, relative to Lebec, of some 200 mm was real and whether it represented movement at Lebec or at Woody. Another interesting point brought up by Jackson was that prior to 1964, the graduated marks on the rods were painted on after the calibration procedure was performed. Thus in these data there is some question about the validity of the calibration procedure. Stein pointed out however, that even with this uncertainty, the various data from different lines are still relatively self-consistent.

Jackson and Strange both commented that there was little redundancy in the earlier surveys (before the 1962 uplift). A further question concerned the likelihood that errors such as rod miscalibration and refraction would produce errors as consistent in space and time as the hypothetical bulge. Stein considered this unlikely. Strange suggested that the change in average sight length in the mid 60's could explain the temporal consistency. Jackson doubted the claimed temporal and spatial consistency of the uplift, but pointed out the change in calibration procedure in 1964, just in case.

A question from the floor concerned the reliability of leveling data on nearly level profiles. Stein and Strange suggested that they should be reliable. Jackson said that current models for refraction predict negligible errors for slopes less than 1%, but that our understanding of refraction is not adequate to be sure of this. Rod miscalibration may be serious on mild slopes if successive readings repeatedly span a small kink in a rod.

Jackson also stated that when height-correlated errors exist over regions of uniform slope, the apparent tilts are also uniform and cannot be distinguished from uniform tectonic tilting. Thus variations in slope are required if systematic errors and tectonic tilting are to be distinguished. Unfortunately, many of the lines run along slopes, such as railroad tracks, that are nearly uniform for practical reasons.

The afternoon session began with a discussion by W. Thatcher (USGS), of a similar aseismic uplift on Izu peninsula in Japan from 1974–present. The uplift has a maximum amplitude of about 20 cm, is in an area noted for compressional tectonics, and is confirmed by gravity data whose maximum amplitude was $-40 \mu\text{Gal}$. Many of the lines which define the uplift run along the coast so height-correlated errors are not a problem. Additionally, the Japanese data had not been corrected for possible refraction effects.

R. Reitinger (Cornell) discussed some of the Southern California leveling data in greater detail. In particular he dis-

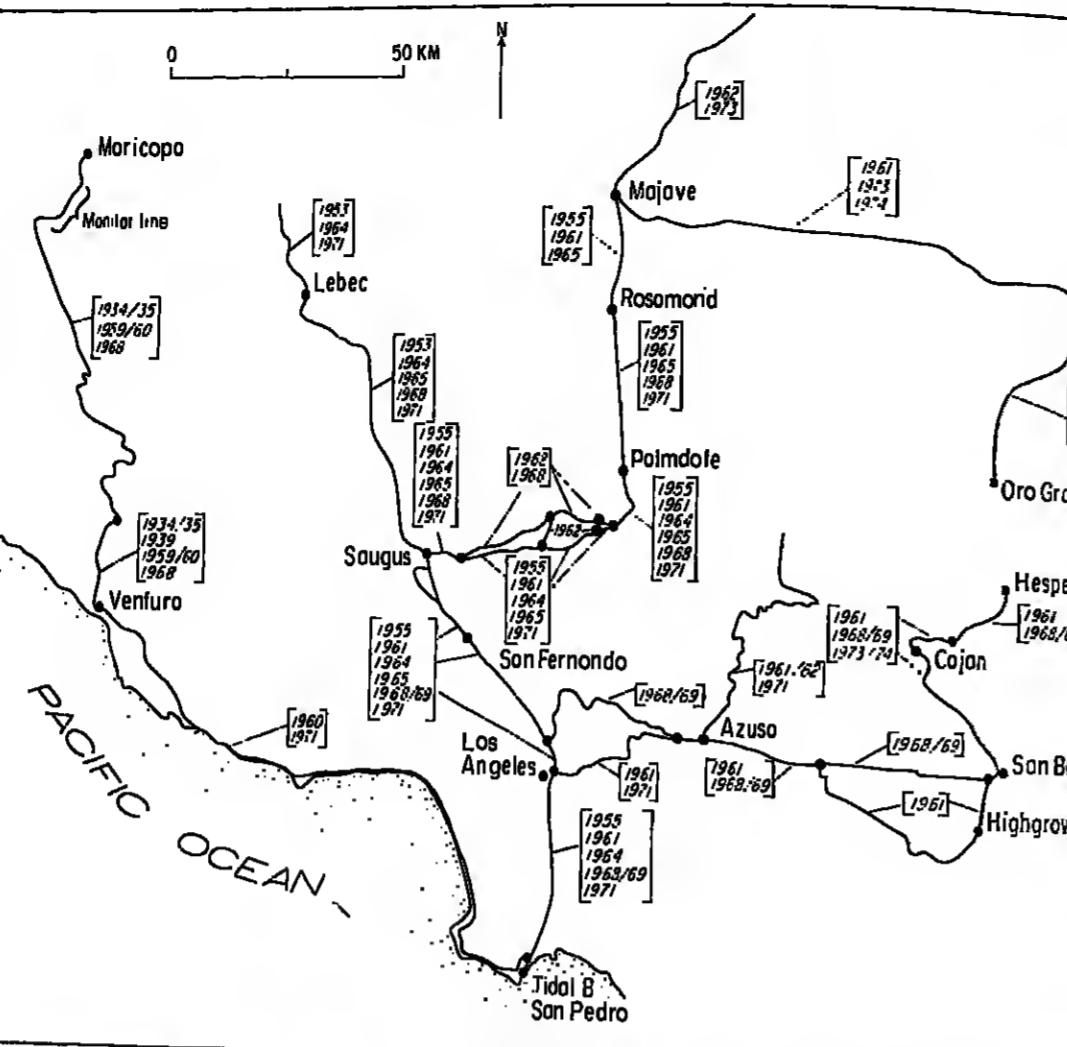


Fig. 1. Levelling lines in the Palmdale region and dates of resurveys up through 1974. (From Casta et al., *Science*, 192, 251–253, 1976)

cussed data from the Saugus basin, an area of active groundwater withdrawal. The leveling lines in this area show some apparent relative subsidence. Taken together with equal dimensions and properties, the possibility of near-surface subsidence is reasonable. Reitinger suggested that while some Southern California leveling measurements appear to reflect tectonic deformation, others are significantly affected by systematic errors and near-surface movements. He concluded that the configuration of the 'Palmdale Bulge' will, at the very least, require revision in light of improved understanding of those factors that can influence leveling observations. Although other leveling data in the U.S. is demonstrably contaminated by height-related errors, Reitinger concludes that the Saugus data show real deformation.

J. Whitcomb (CIRCS) discussed an interesting coincidence of leveling, gravity, and VLBI data at the site of the Jet Propulsion Laboratory. Gravity at 130 sites in the Southern California area has been monitored systematically since 1974 in cooperation with the ARIES/VLBI experiment. In 1975, and again in mid-1979 it appeared that gravity showed a change of $30-50 \mu\text{Gal}$. Both leveling and VLBI showed similar patterns of deformation at the same time, with an amplitude in 1975 of about 10 cm down, and in 1977 of about 5

P. MacDoran (JPL) discussed in more detail the horizontal ARIES observations taken from 1974. These showed general coincidence both in space and time with other horizontal and vertical measurements, particularly the horizontal strain measurements of the USGS. One potentially large source of error in the ARIES technology is the effect of the ionosphere. MacDoran showed one apparent strain event that was in fact due to the influence of a large solar flare, in March 1980, on the ionosphere. When two different means of accounting for ionospheric effects are used, the results are roughly similar.

J. Savage (USGS) discussed horizontal strains that he has observed in the Southern California area since 1971. The most detailed observations temporally were taken in the vicinity of Palmdale. These show a contraction from 1971 to 1979 of about 1 μstrain total, followed by an extensional pulse of 1 μstrain. Since mid-1979, the strain has been essentially constant to within date errors, although there has been a suggestion of a slight upward concavity to the strain since mid-1979. Other strain observations nearer to the San Gabriel fault show some agreement with those at Palmdale, even though observations were not as frequent or at exactly the same times. If it is assumed that all deformation is occurring in Southern California, then the NASA Goddard and Sacramento support Beverage's data as well.

D. Agnew (CIRCS) discussed seismicity data in Southern California that was observed along the San Andreas fault from Lake Hughes to Juniper Hills. Since about November 1976, a relatively intense burst of activity has occurred at both Lake Hughes and Juniper Hills. As time has progressed, the activity has gotten somewhat more diffuse spatially. Most recently, a striking quiescence has occurred from Lebec southeast to Palmdale and from Cajon southeast. The onset of quiescence coincided with several months with the onset of tectonic strain event observed by Savage. Other data shown include the uplift run along the coast so height-correlated errors are not a problem. Additionally, the Japanese data had not been corrected for possible refraction effects.

B. Lechner (CIRCS) described seismicity data in Southern California that was observed along the San Andreas fault from Lake Hughes to Juniper Hills. Since about November 1976, a relatively intense burst of activity has occurred at both Lake Hughes and Juniper Hills. As time has progressed, the activity has gotten somewhat more diffuse spatially. Most recently, a striking quiescence has occurred from Lebec southeast to Palmdale and from Cajon southeast. The onset of quiescence coincided with several months with the onset of tectonic strain event observed by Savage. Other data shown include the uplift run along the coast so height-correlated errors are not a problem. Additionally, the Japanese data had not been corrected for possible refraction effects.

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This session ended on a somewhat ambiguous note because no clear consensus emerged on the part of either the principal speakers or the audience. It appeared that the most intense discussion was over the reality of the pre-1965 data, which would seem to call into question only a part of the total deformation. From the afternoon session, there seemed to be some basis for believing that some activity was occurring in the Transverse Ranges during the mid to late 70's, but exactly what was left unclear. Each of the three principals was firmly committed to his point of view, and each gave convincing arguments. The participants were left with the general feeling that only more analysis, verification experiments, and observations would resolve the issue of whether or not the uplift is indeed real.



Mercie McNutt was born and reared in Minnesota. She received a B.A. in physics from Colorado College in Colorado Springs in 1973 and a Ph.D. in earth sciences from Scripps Institution of Oceanography in 1978. After teaching for a year in the Department of Geology and Geophysics at the University of Minnesota, Mercie joined the Office of Earthquake Studies of the United States Geological Survey in Menlo Park, California. She organized the Annual meeting of the John Muir Geophysical Society as part of her duties as the Society's current secretary. She is likely to retain her post for another year unless someone else volunteers soon.



John B. Rundle is a staff member in the Geophysics Research Division of Sandia National Laboratories in Albuquerque, New Mexico. He obtained a B.S.E. degree in aerospace engineering from Princeton University in 1972, an M.S. in geophysics from UCLA in 1973, and a Ph.D. in geophysics from UCLA in 1978. He spent a year as a postdoctoral fellow at UCLA, and since 1977 he has been at Sandia National Laboratories. His research interests center around modeling crustal deformation processes, using theories of earth models, but also include continuum models for mixtures of elastic and solid and solid-liquid systems. He is a member of the American Geophysical Union, the American Society of Mechanical Engineers, and the Society for Natural Philosophy.

News

North Carolina State Revamps Geosciences

North Carolina State University's Department of Marine Sciences and Engineering and the Department of Geosciences have been combined to form the Department of Marine, Earth, and Atmospheric Sciences, according to university chancellor Joab L. Thomas. The new department is headed by Jay Langfelder, former head of the marine sciences and engineering department.

Langfelder said that the new department will be able to provide a stronger program for students. The marine science and engineering department has traditionally been graduate and research oriented, while undergraduate studies were emphasized in the other department, he said. The combination should help both programs.

The new department offers doctoral degrees with specialties in atmospheric, earth, and marine sciences. ©

Application of Satellite Data to Study of Ocean Surface Energetics

A workshop on 'The Application of Existing Satellite Data to the Study of Ocean Surface Energetics' was held November 19–21, 1980, at the University of Wisconsin-Madison. It was sponsored jointly by the Space Science and Engineering Center, University of Wisconsin-Madison and by NASA.

The major goal of the workshop was to define specific tractable problems by using the existing satellite data set. To this end the present state of research in the area of ocean surface energetics was discussed, with particular emphasis on six topics: heat fluxes at the interface, net radiative budget, currents and topography, wind and wind stress, precipitation, and sea surface temperature.

V. Suomi opened the workshop by reviewing the ongoing research activities that use satellite data. Then F. Bretherton demonstrated the importance of studying the ocean surface energetics for understanding the role of the oceans

on the climate system. He also briefly discussed the accuracy needed for quantitative measurements to be useful for model validation. These review presentations were followed by more technical presentations by the participants during the first day and a half. In the remaining time, discussions were held both in working groups and with the entire group. Reports of the summary and conclusions of each working group, and of all the presentations, are included in the proceedings of the workshop. These proceedings are available from the University of Wisconsin Press.

It is expected that what was accomplished in the workshop will serve as an impetus for further discussion and collaboration among the scientists involved in the remote sensing of the oceans. Subsequent workshops are sure to serve as forums for the growing interest of the science community in this expanding area. These are certain to demonstrate, even more conclusively, the scientific effectiveness of remote sensing tools in the study of oceanographic problems.

This news item was prepared by Catharine Geutier, workshop coordinator, Space Science and Engineering Center, University of Wisconsin-Madison. ©

Geophysicists

W. W. Hutchison, past secretary general of the International Union of Geological Sciences and scientific editor of *Episodes*, has been appointed director general of the Geological Survey of Canada. He replaces D. J. McLaren. Hutchison received this year's Bancroft Medal of the Royal Society of Canada.

J. Venkateswaran Negi, vice chairman of theoretical geophysics at the National Geophysical Research Institute in Hyderabad, India, and B. K. Sahu, of the Indian Institute of Technology in Bombay, have been awarded the 1980 Shanti Swarup Bhatnagar Award in earth sciences. The prize is the highest award for scientist in India.

Senior Position in Earth Science

The Earth Sciences Division of the LAWRENCE BERKELEY LABORATORY has several comprehensive research programs involving the earth sciences. An opening exists for a person with an established national reputation in a scientific discipline in Earth Sciences, preferably geomechanics or hydrogeology, to assume a position of responsibility for the scientific leadership and direction of major research programs such as concerned with radioactive waste storage.

Duties will include taking the scientific initiative and direction and management of ongoing projects, including the nuclear waste isolation field involving more than 30 scientists and engineers at LBL and collaborative work with several academic and research organizations. Additionally, the position involves establishment of emerging programs, expansion of research facilities and pursuit of new areas of investigation.

The successful candidate should have extensive experience and proven capabilities in directing and achieving programme goals of complex research projects involving teams of senior scientists and engineers. A Ph.D. in a field of the Earth Sciences is preferred with significant applicable experience. Salary: over \$50k.

Applicants will be considered no later than April 1, 1981. Interested individuals should forward two resumes including salary history to Employment Office, LAWRENCE BERKELEY LABORATORY, One Cyclotron Drive, Berkeley, CA 94720. An equal opportunity employer M/F.

LAWRENCE BERKELEY LABORATORY

view of relatively small sensitivity to outliers. Design problems are discussed by Th. Leonard and W. Niemeier, as well as by P. A. Cross and B. M. Whiting. Statistical aspects are treated by A. J. Pope (abstract only), E. G. Anderson and J. A. R. Blais (abstract only) and D. G. Milbert. J. J. Kok et al discuss the 1979 adjustment of the EULN European net and its analysis.

C. C. Tscherning compares collocation data with results obtained from other methods for the prediction of gravity anomalies; he basically corroborates Ramsayer's well-established and well-known values for gravity spacing. Other gravity aspects are brought up by P. Venicek and F. A. Kassim; C. C. Goad proves that, for the component M_2 , tidal loading can be sufficiently modeled by using Schwiderski's tide model. G. Helm investigated groundwater effects on repeated leveling results.

Refraction problems in the U.S. are carefully investigated by S. Holdahl; these results, as well as a study on the use of leveling results for dual purposes, are presented in session 5 of the meeting. O. Remmer proposes a modification of Kukkamaki's refraction formula. P. V. Angus-Leppan and F. Brunner discuss additional tests of refraction. Finally, C. T. Whalen presents an interesting comparison of various refraction models in a test field.

W. E. Strange concludes that various systematic errors can lead to totally incorrect geodetic conclusions, whereas E. Gralster studies a time-varying leveling net associated with a nonconservative gravity field. He thus bridges the conceptual gap between dynamic (i.e., oceanic) and geodetic leveling.

Technical aspects (calibration, modification of instruments, hydrostatic leveling, the very important aspect of motorized leveling) are presented by W. D. Forrester, A. Urban, H. Schlammer, E. I. Balazs, M. Takalo, J. M. Becker, B. U. Witte, S. Vemosi, and L. A. Kivioja.

The last session is ended by a comparison of various height determination procedures, including inertial techniques (C. R. Penton). A comparison that deals especially with modern techniques is given by A. Hiltel and J. Haggard, whereas J. F. Falter et al. discuss their highly portable absolute gravimeter which yields accuracy of a few microGals in less than 1 hour.

Finally, the volume contains summaries of the open meeting of IAG Special Study Groups 1.42 and 1.53, as well as a list of participants.

The meeting brought together experts from all over the world, and on the whole the proceedings fully represent the present state of the art in precise leveling.

This volume contains an extremely valuable compendium of scientific papers; at the same time it provides much user-oriented material. Everybody involved in geodynamics, modern geodesy, and datum problems will surely appreciate the quick and competent compilation of this volume. Perhaps some might wonder whether the discussions should have been incorporated; it seems that faster publication was more important.

Reference

Lachapelle, G., Second International symposium on problems related to the redefinition of North American vertical geodetic networks, *Eos Trans. AGU*, 61(39), 846, 1980.

Ervin Gralster is with the National Geodetic Survey, NOS, NOAA, Rockville, Maryland.

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Exploration Geophysicist/University of Oklahoma. The School of Geology and Geophysics at the University of Oklahoma will hire an experienced exploration geophysicist to fill the Frank and Betty Schultz Professorship, and is seeking nominations and applications for the position. The person must be a distinguished scientist who has made important contributions to exploration geophysics through research. Preference will be given to a scientist whose specialty is seismic properties of earth materials and who has earned the Ph.D. The Schultz Professor will provide leadership and guidance in establishing a clearly teaching and research exploration geophysics group. The University of Oklahoma has recently made a strong commitment to the earth sciences with the establishment of a College of Geosciences, to be housed in a new building. The School of Geology and Geophysics will expand from its present strength of 18 to 26 faculty members by 1986. This will include three scientists in the exploration geophysics area, five in structure-tectonophysics, solid earth geophysics and others in stratigraphy-paleontology, geochemistry, petrology, and energy resources.

Applications are due April 30, 1981. Inquiries, nominations, and applications should be sent to John Wickham, Director, School of Geology and Geophysics, University of Oklahoma, Norman, OK 73019. The University of Oklahoma is an equal opportunity employer.

Solid Planet Geophysicist/Texas A&M University. The Department of Geophysics at Texas A&M University is pleased to announce availability of a junior level tenure track faculty position. The department emphasizes solid earth geophysics with concentrations in tectonophysics, petrogeodynamics and internal structure. We are seeking a talented and active researcher and teacher who will complement, strengthen, and broaden current areas of expertise. There are excellent opportunities for interaction and collaboration with members of our department as well as those in the departments of oceanography and geology and in the center for tectonophysics. Qualified scientists are requested to send resumes to Neville L. Carter, Head, Department of Geophysics, Texas A&M University, College Station, TX 77843.

Texas A&M University is an equal opportunity employer.

The Hebrew University of Jerusalem. **Structural Geologist/Geophysicist.** Applications are invited for a tenure track position in structural geology and/or geophysics, to be held at the senior lecturer or associate professor level, after October 1981.

The appointee is expected to develop a strong research program and to offer courses in his own field of research and related subjects at graduate and undergraduate levels (including introductory and field courses) as well as to advise M.Sc. and Ph.D. students. The department carries out a vigorous research program and cooperation with other staff members is both possible and desirable.

Applicants should forward a curriculum vitae, list of publications and two letters of recommendation to: The Chairman, Department of Geology, Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel.

Assistant Professors in Atmospheric Science: Climate dynamics. Qualifications: Ph.D. in atmospheric science or related field with strong background and evidence of experience in the theory, phenomenology, and numerical modeling of atmospheric motion systems and a demonstrated interest in the study of climate and its physical basis.

Teaching responsibilities include: numerical prediction course and sharing teaching of one or two other undergraduate courses in basic and applied theory and phenomenology and one graduate level course.

Research focus is on climate, its emergence and dynamics. These studies would complement existing projects involving hydrologic cycles, regional evapotranspiration, trace gas transport and air pollution effects.

Applicants should submit resume, transcripts, copies of publications, and the names and addresses of at least three references to: Dr. Brian Wexler, Search Committee, Department of Land, Air, and Water Resources, University of California, Davis, CA 95616, by May 15, 1981.

The University of California is an equal opportunity/affirmative action employer and invites applications from all qualified individuals.

Research Fellow Associate Solution Geochemistry. The Australian National University invites applications for appointment to the position of research fellow—associate solution geochemistry, in the Research School of Earth Sciences from those holding a Ph.D. degree in a relevant field.

The Research School of Earth Sciences has recently established an interdisciplinary research group in environmental geochemistry. Current areas of research include application of stable isotopes and radiocarbon to the geochemical evolution of the Great Barrier Reef, the Gulf of Carpentaria and the geochemical evolution in the sediments of Australian inland lakes. Special attention is also being devoted to hydrocarbon paleogeobiology and the carbon cycle. The group wishes to appoint a research fellow specializing in aqueous solution geochemistry to work on a collaborative basis on research projects in the above areas.

In addition to participating in collaborative research programs, the appointee will have the opportunity of pursuing independent research in general areas of interest to the group. The geochemical environment of Australian inland lakes and groundwater is of particular interest and the appointee should be prepared to participate in a major research program aimed at understanding the solubility, transport and precipitation of chemical species in heterogeneous aqueous solutions and sediments. A wide range of evaporate minerals are known to occur in these basins at the present time.

Consequently, the research undertaken by the successful applicant may have implications not only to environmental geochemistry and paleogeobiology but also to economically significant topics such as the mobilization, fixation and migration of metals and other elements of economic significance.

Applicants should have broad interests in geochemistry, together with a strong background in theoretical research geochemistry and relevant experimental-chemical techniques. In addition to describing their qualifications, applicants are invited to submit research proposals detailing the general research directions and specific projects which they would wish to pursue. Further information concerning the position can be obtained directly from Dr. W. Compston.

Salary on appointment will be in accordance with qualifications and experience within the range: Research fellow \$19,132-\$24,572 per annum. Appointment will be for 2 or 3 years in the first instance with the possibility of extension to five years. Superannuation, housing assistance, reasonable appointment costs.

The University reserves the right not to make an appointment or to make an appointment by invitation at any time. No fixed closing date is specified for the above position.

Interested candidates are requested to submit their applications to The Registrar, Australian National University, PO Box 4, Canberra, ACT 2600, Australia.

Assistant Professor, Hydrology/Water Resources. Tenure track appointment involving teaching and research in hydrology and water resources. Excellent opportunities for interdisciplinary collaboration with ecologists, meteorologists, geologists, and hydrologists. Please call or send resume, M. Hemberger, Department of Environmental Sciences, Clark Hall, University of Virginia, Charlottesville, Virginia 22903. Closing date for applications April 15, 1981. The University of Virginia is an Equal Opportunity/Affirmative Action Employer.

Geophyseologist/Structural Geologist, Albion College. A tenure track position, commencing Fall 1981, is open at the assistant professor level at Albion College's Department of Geological Sciences. The position involves teaching undergraduate laboratory courses in structural geology and geophysics and introductory lab courses or non-lab courses in geology. The Department is developing a geophysics major and has some geophysics candidates. Candidates with a Ph.D. or who are about to acquire a Ph.D. are preferred.

Depending upon the applicant's background, the new staff member may have the opportunity to assist in teaching at Albion's geology field camp for methods course is offered to students from many in the Front Range near Boulder, Colorado.

Albion College is a co-educational liberal arts college located in southern Michigan, an hour's drive from Michigan State University. The University of Michigan and Western Michigan University. The Department has four staff members and 30 to 40 a floor-and-a-half of a new science center.

Resume, transcripts and three letters of reference should be submitted to: Prof. Lawrence D. Taylor, Department of Geological Sciences, Albion College, Albion, Michigan 49224.

Albion College is an equal opportunity employer.

Structural Geologist. The Department of Geosciences of Purdue University invites application for tenure track faculty position in structural geology, starting in August 1981. Rank and salary will be quoted. The individual will be expected to teach undergraduate and graduate courses in structural geology and tectonics, participate in summer field courses, and pursue an active research program.

Preference will be given to a candidate with an applied field orientation and a strong background in the quantitative analysis of field data. The department has active programs in petrology, geochemistry, and engineering geology and has a close working relationship with the geological group in civil engineering and the laboratory for Applications of Remote Sensing, closing date for application is April 1, 1981.

Applicants should send a resume, the names, addresses, and telephone numbers of three referees, and a brief statement of research interests to R.H. McClester, Department of Geosciences, Purdue University, West Lafayette, IN 47907.

Purdue University is an equal opportunity/affirmative action employer.

Seismologist. The Department of Geology at the University of Illinois, Urbana-Champaign, has an opening for a tenure track position at the assistant professor level, beginning during the 1981-82 academic year. A Ph.D. is required. The applicant should have a strong background in geology, and post-doctoral experience is desirable. Candidates with interests and experience in tectonic studies based on seismological observations will be given preference. The successful candidate is expected to develop an active research program to complement existing programs in geomorphology, solid earth geophysics, and rock physics. There is also opportunity for interaction with programs in the Department of Theoretical & Applied Mechanics and Civil Engineering, and the Interdisciplinary Materials Research Laboratory. Send resume and names of three references to Prof. J. Won, Search Committee Chairman, Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27850, USA. We hope to make a final decision by April 15, 1981.

The University of Illinois is an equal opportunity/affirmative action employer.

Geophysicist North Carolina State University—Raleigh. The Department of Marine, Earth and Atmospheric Sciences invites applications for a presently available tenure track position in geophysics. Rank and salary are open, depending on qualifications and experience. A Ph.D. is required. Applied or exploration geophysics orientation are preferable; however, other specializations in geophysics also will be considered.

Primary responsibilities will include generating and conducting research programs as well as teaching graduate courses in geophysics. The department currently consists of 31 regular faculty members including 18 in the areas of geology and geophysics. Please send resume and names of three references to Prof. J. Won, Search Committee Chairman, Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27850, USA. We hope to make a final decision by April 15, 1981.

The University of Illinois is an equal opportunity/affirmative action employer.

Geophysicist/Mineralogist/Geobiologist. The Tennessee Earthquake Information Center (TEIC) is seeking applications for the position of seismologist beginning July 1981. The position will also be a joint tenure track appointment in the Department of Geology. Primary duties, however, are with TEIC; teaching will be on a time-available basis, not to exceed one course per semester.

The Ph.D. is required and experience with telemetric networks is highly desirable. The successful applicant will be expected to assume co-project responsibilities on the Memphis and Southern Appalachian seismic networks, as well as actively pursue externally funded research projects, digital data processing, seismic hazard assessment and public information are other aspects of the job.

The TEIC is a research organization of Memphis State University and the State of Tennessee, 12-month salary (\$25,000 and above) depends on qualifications and experience. Position is 4% state supported, 1/2 summer from external sources.

Application deadline: 15 April 1981. Send resume, publication list, short statement of research interests, and names and addresses of four references to:

Arch Johnston, Director
Tennessee Earthquake Information Center
Memphis State University
Memphis, Tennessee 38152

Memphis State University is an equal opportunity/affirmative action employer.

Faculty Position: University of Iowa. The Department of Physics and Astronomy anticipates one or two openings for tenure track faculty in August 1981. Research specialties for which substantial resources are available are magnetospheric and ionospheric physics and space and laboratory plasma physics, both theoretical and experimental. Other specialties of interest are astronomy, astrophysics, elementary particle physics, atomic physics, condensed matter, and low energy nuclear physics.

The positions involve undergraduate and graduate teaching, guidance of research students, and personal research. Interested persons should send a resume, a statement of research interests, and names of three professional references to Search Committee, Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242.

The University of Iowa is an equal opportunity/affirmative action employer.

Faculty Position: University of New Mexico.

This Department of Geology at the University of New Mexico Invites applications for the Vincent C. Kelley and Leon T. Silver Graduate Fellowships. The fellowship will be awarded on the basis of the academic promise of graduate applicants. Each fellowship will provide a generous living stipend of \$1,000/month for 9 to 12 months, end up to \$2,000/year for travel and research expenses.

The Caswell Silver Foundation will pay all tuition and university fees. The awards are made on an annual basis, but may be renewed for up to three years as long as the student maintains excellent academic standing and shows evidence of significant progress in research. Preference will be given to, but is not restricted to, applicants for the Ph.D. program.

An application for admission to the UNM Graduate Program, transcripts, references and a brief statement of research goals are required for consideration for the fellowships. Application materials may be obtained from:

Rodney C. Ewing
Chairman
Department of Geology
University of New Mexico
Albuquerque, New Mexico 87131

The dead line for applications is April 1, 1981 for the Fall semester of 1981.

RESEARCH POSITION

THE UNIVERSITY OF NEW MEXICO

RESEARCH POSITION

Meetings

One Year After Mount St. Helens

A call for papers has been issued for a symposium on the physical and social impacts of the Mount St. Helens eruptions. Technical sessions will be held on May 18, 1 year after the first major blast. A preliminary program is scheduled for May 17. The symposium, to be held at the Eastern Washington University in Cheney, Washington, may be continued through May 19, depending on response to the announcement.

Technical sessions will be split into those covering physical science and environment and those on the psychological, social, and economic aspects of the eruption. Included will be discussions of agriculture and soils, hydrology and water quality, wildlife and insects, remote sensing, the impact on school systems and students, the economic impact, marketing of eruption souvenirs, and the federal role in disaster assistance.

Deadline for receipt of one-page abstracts is March 20. Special arrangements needed for presentation of papers should be listed on a second page. Send abstracts, inquiries, and requests for registration forms to Michael M. Folsom, Symposium Coordinator for Physical Science and the Environment, Department of Geography and Anthropology, Eastern Washington University, Cheney, WA 99004.

Holme Symposium on Geodesy

The Eighth Holme Symposium on Mathematical Geodesy will be held September 7-9 in Como, Italy, under the auspices of the International Association of Geodesy.

Those interested in attending should immediately contact F. Sansò, Istituto di Topografia, Fotogrammetria e Geodetica, Piazza Leonardo da Vinci, 32, 20133 Milano, Italy.

FUTURE AGU MEETINGS

Chapman Conference

Spatial Variability in Hydrologic Modeling
July 21-23, 1981, Colorado State University,
Fort Collins, Colorado

Generation of the Oceanic Lithosphere
April 6-10, 1981, Airlie House, Warrenton, Virginia

1981 Midwest Meeting
September 17-18, 1981, Radisson Hotel, Minneapolis, Minnesota

1981 Pacific Northwest Meeting
September 17-18, 1981, Central Washington University, Ellensburg, Washington

AGU Oceanography Section/ASLO (American Society of Limnologists and Oceanographers) Meeting
February 16-18, 1982, St. Anthony Hotel, El Tropicano Hotel, Gunter Hotel, San Antonio, Texas

Fall Meetings
December 7-11, 1981, San Francisco
December 6-10, 1982, San Francisco
December 5-9, 1983, San Francisco

Spring Meetings
May 25-29, 1981, Baltimore
May 31-June 4, 1982, Philadelphia

Geodesy in Africa

The Second Symposium on Geodesy in Africa will be held at the Kenyatta Conference Centre in Nairobi, Kenya, November 9-20. The symposium is sponsored by the International Association of Geodesy, in collaboration with the IUGG Local Committee of Kenya, the IUGG Committee on Advice to Developing Countries, and the African Association of Cartography.

The theme of the symposium is "Geodesy in Africa in the 1980's." R. Oluwole Coker, president of the Commission for Geodesy in Africa, is the convener.

Requests to contribute reports and papers and/or registration forms and general information should be directed to R. Oluwole Coker, Survey of Kenya, P.O. Box 30046, Nairobi, Kenya, or to Coker, Kenling Africa Resource Service, 53 Lawson Street, P.O. Box 1858, Legos, Nigeria.

AGU Congressional Science Fellowship

The individual selected will spend a year on the staff of a congressional committee or a House or Senate member, advising on a wide range of scientific issues as they pertain to public policy questions.

Potential applicants should have a broad background in science, be articulate, literate, flexible, and able to work well with people from diverse professional backgrounds. Prior experience in public policy is not necessary, although such experience and/or a demonstrable interest in applying science to the solution of public problems is desirable.

The fellowship carries with it a stipend of up to \$25,000 plus travel allowances.

Interested candidates should submit a letter of intent, a curriculum vitae, and three letters of recommendation to AGU. For further details, write Member Programs Division, Congressional Fellowship Program, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

Deadline: March 31, 1981.

For your AGU Annual Meeting flight reservations

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(In Ill. 312-569-3375)
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Chapman Conference on Spatial Variability in Hydrologic Modeling

July 21-23, 1981
Colorado State University, Fort Collins

Purpose: The conference will provide a forum where surface and groundwater hydrologists, soil scientists, and applied hydrogeologists can discuss progress and research approaches in dealing with spatial variability of catchment surface and subsurface properties in a distributed modeling context.

Call for Papers: Published in December 16, 1980. EOS, includes program topics planned. Abstract deadline: May 15, 1981.

Convenors: D. A. Woolhiser and H.-J. Morel-Seytoux.

Student Travel: Some travel money will be available to students. To apply, write to AGU, giving your educational background and your advisor's name. Briefly explain the reasons you wish to attend.

For further information, call or write Member Programs Division, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 (telephone: 202/462-6903).

AGU CHAPMAN CONFERENCE Generation of the Oceanic Lithosphere

April 6-10, 1981 Airlie House, Warrenton, Virginia

Convenors: D. C. Presnall, A. L. Hines, and F. A. Frey

Sessions planned to date:

- (1) Constitution of the crust and upper mantle of spreading centers
- (2) Trace elements and isotopes
- (3) Experimental petrology
- (4) Magmatic processes versus spreading rate
- (5) Magmatic chamber dynamics, melt migration, magma flow
- (6) Tectonics of spreading centers
- (7) Hydrothermal activity, metamorphism

Limited space remains. For information on registration and accommodations, write to AGU, Meetings, 2000 Florida Avenue, N.W., Washington, D.C. 20009, or call Meetings, (202) 462-6903.

Acoustic Emissions and Microseismicity

A special conference on Acoustic Emission/Microseismicity Activity in Geologic Structures and Materials will be held October 5-7 at The Pennsylvania State University. The conference is sponsored by the Rock Mechanics Laboratory of the university's Department of Mineral Engineering.

The conference will consider the application of acoustic emission/microseismicity techniques to a range of field and laboratory problems in general geomechanics, including stability evaluation of underground gas storage reservoirs, solution-mined caverns, earth-filled dams and tunnels, site control in coal and hard-rock mines, earthquake mechanics, and fundamental behavior of geological materials.

For additional information, contact H. Reginald Hardy, Jr., Director, Rock Mechanics Laboratory, Room 117, Mineral Sciences Building, The Pennsylvania State University, University Park, Pennsylvania 16802.

Hydrology Day in Fort Collins

The AGU Front Range Branch has issued a call for papers for its Hydrology Day, scheduled for April 23 at Colorado State University in Fort Collins.

Hydrologist and hydrology students interested in presenting a paper should send an original plus two copies of a one-page double-spaced typed sheet that lists authors' names, affiliation, address, telephone number, like of paper, and a brief (roughly one-half page) abstract to H. Morel-Seytoux, Vice Chairman, AGU Front Range Branch A305, Engineering Research Center, Colorado State University, Fort Collins, Colo. 80523. The meeting planners also recommend that potential contributors call Morel-Seytoux at (303) 491-8549.

Deadline for acceptance of abstracts or telephone calls is March 13. Papers missing the deadline will be scheduled for presentation but will not be included in the program.

There is no registration fee for attendees and AGU Front Range members. A nominal registration fee may be charged to others. Additional questions should be directed to the vice chairman.

A prize will be awarded by the Front Range Branch to the best student paper in each of three categories: undergraduate, masters, and Ph.D. candidates.

New Listings

The complete Geophysical Year list appeared in the Feb. 10 EOS.

Below type indicates meetings sponsored or cosponsored by AGU.

1981

Apr. 14-15 National Water Conservation Conference—Publicly Supplied Potable Water, Denver, Colo. Sponsored by EPA. (National Water Conservation Conference, c/o Enviro Control, Inc., P.O. Box 827, Rockville, MD 20851.)

May 11-13 Annual Meeting, Canadian Geophysical Union, Calgary, Alberta, Canada. (P. J. Savage, Pen-Canadian Petroleum Ltd., P.O. Box 2805, Calgary, Alberta, Canada T2P 2S5.)

May 11-15 1981 Seminar on Tropical Cyclone Hydrology, Miami, Fla. Sponsored by WMO, NOAA, (Allen F. Flanders, National Weather Service, 8060 13th St., Room 808, Silver Spring, MD 20910.)

July 21-23 Chapman Conference on Spatial Variability in Hydrologic Modelling, Fort Collins, Colo. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

Aug. 24-28 Eighth Annual Meeting of the European Geophysical Society, Uppsala, Sweden. (C.-E. Lund, Chairman Local Organizing Committee, Institute of Solid Earth Physics, Uppsala University, Box 556, 752 22 Uppsala, Sweden.)

Sept. 17-18 Midwest Meeting, Minneapolis, Minn. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

Sept. 17-18 Pacific Northwest Regional Meeting, Ellensburg, Wash. (Bob Bentley, PNAGU, Central Washington University, P.O. Box 1000, Department of Geology, Ellensburg, WA 98920.)

Oct. 11-15 51st Annual International Meeting of the Society of Exploration Geophysicists, Los Angeles, Calif. (William L. Baker, Technical Program Chairman, Chevron Oil Field Research Co., Box 446, La Habra, Calif. 90631.)

Oct. 13-16 Division of Planetary Sciences of the American Astronomical Society Annual Meeting, Peoria, Ill. (B. Hapke, Dept. of Geology and Planetary Sciences, 321 Old Engineering Hall, University of Pittsburgh, PA 15260.)

Oct. 14-16 Third Surveying and Mapping Conference, the Petroleum Industry, Banff, Alberta, Canada. (Society of Canadian Petroleum Association, 1500, 833 Sixth Avenue, Calgary, Alberta, Canada T2P 2Y5.)

Oct. 26-30 Symposium on Quaternary Landscapes and Glaciation, Edinburgh, U.K. (Edinburgh, Quaternary Landscapes and Glaciation, 1981, Organizing Committee, Department of Geosciences, Edinburgh University, Edinburgh, U.K.)

Oct. 26-30 Symposium on Coastal and Estuarine Geodynamics, California. (Coastal and Estuarine Geodynamics, 1981, Organizing Committee, Department of Geosciences, University of California, Santa Barbara, Calif. 93106.)

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